



Nosocomial infections in surgical departments

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Abstract Nosocomial infection (NI) continues to represent a major public health problem worldwide. HAIs have major consequences both economically and medically, with prolonged hospitalization, temporary or permanent work disability, complications, and even death. In Romania, The Surveillance and Prevention Service of Nosocomial Infections (SSPCIN) conducts periodical training sessions with the medical staff to prevent nosocomial infections. The antibiotic resistance of pathogens associated with nosocomial infections is becoming a major therapeutic challenge for all physicians. A close collaboration between different departments (clinician, clinical lab, infectious diseases specialist, epidemiology department, surgeon, intensive care specialist) is also necessary for the identification, detection, and treatment of Nis. To avoid the increase of NI cases, all the data must be accurately reported to the Public Health Board, according to the current legal frame.

Key Words: Nosocomial infections, surgery

In 1847, Ignaz Semmelweis presented evidence that childbed fever was spread from person to person on the unclean hands of health-care workers. Semmelweis's discovery did not immediately improve sanitary conditions in hospitals, but surgeons gradually adopted aseptic and antiseptic techniques and became leading innovators of techniques to reduce patients' susceptibility to postoperative infections (1). By the late 1950s and early 1960s, a small proportion of hospitals worldwide had begun to implement programs designed to understand and control hospital-acquired infections (HAIs) (2).

Nosocomial infection (NI) continues to represent a major public health problem worldwide. HAIs have major consequences both economically and medically, with prolonged hospitalization, temporary or permanent work disability, complications, and even death (3).

Is an infection acquired by the patient in a hospital or other healthcare facilities that appear after discharge or during hospitalization. Knowing the period of incubation allows us to differentiate it from community-acquired or previous hospitalization infections. Among these patients, it may cause major morbidity and mortality, psychoemotional distress and economic burden (3).

In Romania, The Surveillance and Prevention Service of Nosocomial Infections (SSPCIN) conducts periodical training sessions with the medical staff to prevent nosocomial infections. (4,5)

The main objectives of nosocomial infection surveillance are:

- knowledge of the incident, identification of hazard and risk factors and responsible etiological agents;
- early detection of cases in order to reduce their impact;
- evaluation of the activity of preventing and combating nosocomial infections;
- knowledge of the incidence of the most relevant categories of nosocomial infections from an epidemiological point of view. (4)

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Received November 19, 2022; Accepted December 15, 2022; Published December 30, 2022

Citation: Manciu Carmen, Sapaniuc Cristina: Nosocomial infections in surgical departments. Journal of Surgery [Jurnalul de chirurgie]. 2022; 18(4): 263 – 267. DOI:10.7438/JSURG.2022.04.01

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The term of nosocomial infection outbreak is established when three or more cases of nosocomial infection are caused by the same type of microorganism, which appears in the same department and in a period of time equal to the specific maximum incubation (6).

NI occur most often in patients who have a prolonged exposure or hospitalization time, so that the main compartments where these infections can occur are surgical compartments (surgical wound and other soft tissue infections, blood stream infections, etc.) and intensive care units (7).

In addition to the long period of exposure to the hospital set up, we also add the fact that these patients are immunosuppressed not only because of the associated pathologies but also because of the surgery they suffered, during the procedure, the barrier of the skin or the protective visceral layers being compromised (8).

Nosocomial infections are sub-divided according to the access gate or the system affected in:

- respiratory infections;
- urinary infections;
- digestive infections;
- visceral infections (peritoneal, etc.);
- wound infections (operative wound, injury wound, etc.) (9).

Intra-abdominal infections implicate a wide spectrum of conditions. Most are due to the microorganisms' migration from the gastrointestinal tract to the sterile area of the abdominal cavity, as a result of the damage of the intestinal wall from spontaneous perforations (appendicitis, perforated ulcer, diverticulitis), trauma, or surgical interventions (10).

Postoperative wound infection commonly occurs between the fifth and tenth days after surgery but can also occur from the first day onwards to many years after the procedure. It may originate during the intervention as a primary wound infection or may occur after, from external sources or as a result of secondary wound complications when the patient may present pain, drainage, warmth, swelling, tenderness, erythema, fever, and chills (11).

There are three main types of postoperative infections:

- superficial infection of the surgical wound: involves the skin and subcutaneous tissue; these infections are responsible for approx. 50% of postoperative infections; at least one criterion must be met: purulent secretion, isolated microorganism, at least one sign of infection;
- deep infection of the operative wound: involves the deep tissues (muscles and fascial planes); at least one criterion must be met: secretion with a purulent appearance, wound dehiscence, suspicion of confirmed abscess formation or other deep infection diagnosed by the surgeon;
- organic infection. It is installed in any other body region apart from the skin, muscles and muscular fascia, such as at the level of an organ or in the space between two organs; although it appears at a distance from the incised area, it is closely related to the initial surgical procedure. (12)

Nosocomial surgical-site infections (NSSIs) are the most frequent cause for postoperative readmission, the most common nosocomial infection among surgical patients, and have the highest HAI type cost. It includes poorer patient outcome, increased hospital stays, and lower reimbursements to hospitals (13). Center of Disease Control and Prevention (CDC) classifies it as an infection in an "incisional organ or organ space manipulated during an operation" that appears within 30 days of surgery or within 90 days of surgery of a prosthetic device is implanted (14).

The site of infection may be limited to the suture line or may be extended to the operative site with variable infecting microorganisms, depending on the type and localization of the surgery, and the antimicrobials received by the patient (14,15).

NSSIs are most frequent caused by bacteria or fungous invasion of the skin, soft tissue or organ throw a traumatic episode or during/after surgery (15).

Studies showed that NSSIs are the second most common HAIs next to urinary tract infections, counting 17% of all health care-associated infections and nosocomial bloodstream infections (BSIs) that represent 14%

of total NI, can be classified as primary or secondary (16,17)

The most common organisms that are involved in routine surgery's that do not involve the respiratory, gastrointestinal, and female genital tract, are gram-positive bacteria (e.g. *Staphylococcus aureus*, *coagulase-negative staphylococcus*, *streptococcus*, etc.) (18).

For surgeries that involve the gastrointestinal and/or the female genital tracts we take in consideration gram-positive bacteria, gram-negative bacteria, and anaerobes (19).

Infections resulting from surgical interventions or recurrences after antibacterial therapy may involve drug-resistant pathogenic germs such as gram-negative facultative bacilli, staphylococcus, or *Pseudomonas aeruginosa*. These are distinct from most intra-abdominal infections with pathogens acquired from the endogenous flora (20).

Intra-abdominal infections result from the invasion of bacteria into the wall of abdominal cavities and their proliferation results in peritonitis or abscesses. When the infection spreads into the peritoneal cavity or other normally sterile regions of the abdomen, it is referred to as a complicated intra-abdominal infection (21).

Almost all intra-abdominal infections are polymicrobial and are caused by the bacteria of the intestinal flora (aerobes and anaerobes - Enterobacteriaceae, Enterococcus and Bacteroides fragilis are most frequently isolated). The emergence of antibiotic resistance (e.g., ESBL-producing Enterobacteriaceae or multi-resistant enterococcus and staphylococcus) represents a massive threat for patients with surgical infections (22).

In general, it can be assumed that the number of pathogens involved in intra-abdominal infections is underestimated, typically 5 to 10 bacterial species are detected per intra-abdominal sample taken. The most frequently isolated are Gram-negative Enterobacteriaceae such as *Escherichia coli* and *Klebsiella pneumoniae* as well as Gram-positive enterococci (*Enterococcus faecalis*, *Enterococcus faecium*) and *Bacteroides fragilis* (23).

Inadequate empiric antibiotic treatment can lead to treatment failure, particularly in patients with nosocomial infections and even to death. In patients at risk, broad-spectrum antibiotic regimens, including resistant gram-negative pathogens and anaerobes, as well as gram-positive bacteria such as enterococcus (including vancomycin-resistant enterococcus - VRE) and staphylococcus, should be taken into account when selecting therapy (24).

When we have this suspicion, we should obtain cultures before initiating the antibiotic therapy so we can identify the causative pathogen and after, initiate the empiric therapy. The goal of antimicrobial therapy is to prevent infectious recurrences, to reduce surgical wound complications and to control bacteraemia (25,26,27,28).

Conclusion:

Nosocomial infections are associated with high morbidity and mortality and reduce the patient's quality of life after surgery. Moreover, their prolonged hospitalization represents an economic burden for health services. Despite different guidelines endorsed by scientific societies describing recommendations for preventing and treating nosocomial infections, they still represent a challenge for health-care staff and health-care system.

The antibiotic resistance of pathogens associated with nosocomial infections is becoming a major therapeutic challenge for all physicians.

A close collaboration between different departments (clinician, clinical lab, infectious diseases specialist, epidemiology department, surgeon, intensive care specialist) is also necessary for the identification, detection, and treatment of Nis. To avoid the increase of NI cases, all the data must be accurately reported to the Public Health Board, according to the current legal frame.

Disclosure: authors have nothing to disclose

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